Monitoring Program Identification Process

Introduction

After completion of the assessment and prescription process, management practices developed by the prescription team will be applied in the sensitive areas identified. The managers of the forest, fish and water resources need to know whether these prescriptions are working and if resource goals are being achieved. Monitoring information can play an important role in evaluating the effectiveness of watershed analysis, determining trends in the conditions of resources and providing direction for future resource management. (See Figure I-1 in the Introduction to Watershed Analysis section).

The purpose of the monitoring module is to provide guidance for monitoring programs to evaluate the effectiveness of watershed analysis in achieving watershed-specific objectives. Monitoring must answer two questions in order to be useful in the context of watershed analysis: 1) are the prescriptions effective in preventing cumulative effects; and 2) how are the resources of concern responding to the protection provided by watershed analysis?

The effectiveness of forest practices prescriptions can be determined by monitoring the response of triggering mechanisms and input processes. Monitoring the status of stream channel, fish habitat and water quality conditions can determine if the resource objectives of the watershed analysis are being met.

The formal mechanism for using monitoring information in evaluation of watershed analysis and adaptive management is provided by WAC 222-22-090 *(4) of the forest practices rules. This section requires DNR to evaluate the effectiveness of prescriptions in providing for protection and recovery of resources in cases where the condition of resource characteristics or indices of resource conditions is fair or poor. If resource conditions are found to be fair or poor, information gathered through monitoring will be critical for evaluating whether the trend in resource condition is improving consistent with the intentions of the WAC.

In addition, monitoring information can be used to guide local management decisions and cooperative efforts for additional resource benefits. Monitoring can provide adaptive management feedback to help refine and improve the analysis over time.

The monitoring module is based on several underlying principles. Watershed analysis monitoring uses a watershed-based approach that examines the relationships between prescriptions, triggering mechanisms, input processes and associated channel, habitat and water quality effects. These linkages provide a context for interpretation of monitoring results. Monitoring plans are developed and implemented locally (for each watershed) and cooperative monitoring efforts are encouraged to reduce costs and share responsibilities.

Monitoring parameters are chosen to be consistent with local conditions, processes, and resources based on watershed-specific information from the causal mechanism, resource assessment, and prescription reports and the knowledge of people familiar with the watershed. Standard methods will be available.

This module provides guidance so people with different backgrounds and skills can develop monitoring plans that will produce consistent and useful monitoring information.

Critical Questions

Watershed analysis monitoring is designed to answer two fundamental questions:

Are the prescriptions effective in controlling identified trigger mechanisms and maintaining related input processes within acceptable ranges?

Are the conditions of the channel, fish habitat, water quality, water supply or public works responding as expected?

Assumptions

Watershed analysis monitoring is based on the following assumptions:

1. Cause and effect linkages exist between forest practices (prescriptions), triggering mechanisms, input processes and channel, fish habitat, water quality, water supply and public works conditions.

2. The Causal Mechanism Reports identify the key linkages and provide testable hypotheses that can be used to test the effectiveness of watershed analysis.

3. Changes in the condition of stream channels, fish habitat and water quality, water supply and public works can be detected and measured.

4. Trends in resource conditions over space and time can be distinguished from natural variability.

Overview of Procedure and Products

The following is a listing of when the major steps occur in the watershed analysis process for preparing a monitoring plan and implementing a cooperative monitoring program. The product produced is a Monitoring Plan Report for filing with DNR and for use during cooperative implementation efforts.

Start-up

- Project manager instructs each resource assessment team leader and prescription team leader to identify potential monitoring objectives.

Resource Assessment

- Assessment teams identify potential monitoring objectives.

Synthesis

- Assessment team leaders discuss potential monitoring objectives during the module report presentations.

Prescription

- Prescription teams identify potential monitoring objectives.

Wrap-up

- Wrap-up team discusses potential monitoring objectives.
- Team selects final monitoring objectives for inclusion in the monitoring plan.
- Prepare the monitoring plan report for filing with DNR.

Voluntary Implementation

- Project manager convenes stakeholders to discuss monitoring plan report.
- Identify participants volunteering for monitoring implementation.
- Select a coordinator from volunteering participants.
- Develop a cooperative monitoring implementation workplan.
- Implement the workplan.

Qualifications

Participating resource analysts, managers, and members of assessment and prescription teams are qualified to participate in the development of a monitoring plan.

Background Information

Much of the information needed to prepare a watershed analysis monitoring plan is found in the watershed analysis documents. The team will need a copy of the resource assessment, causal mechanism, and prescription reports. Maps showing areas of resource sensitivity and channel response segments will be needed. Other useful information includes past monitoring data and sources of standard methods, such as the TFW Ambient Monitoring Program Manual.

Procedure

The procedure for the Watershed Analysis Monitoring Module is presented in two sections. The first section describes how to develop a monitoring plan. The second section discusses cooperative implementation of the plan and procedures for collecting, interpreting and using monitoring data.

Section 1. Developing a Watershed Analysis Monitoring Plan

Each monitoring plan is developed during the wrap-up phase by representatives of the resource assessment and prescription teams. The plans are tailored to watershed-specific conditions and concerns documented in the resource assessment, causal mechanism, and prescription reports. The monitoring module does not generate the local information needed to develop a monitoring plan. Instead, it provides guidance for using information gathered during watershed analysis along with other local sources to develop an effective monitoring plan.

Step 1: Initial Discussion

During the start-up phase of watershed analysis the project manager should discuss the issue of monitoring with participating organizations and stakeholders, informing them that a monitoring plan will be developed during wrap-up and that a decision on whether to cooperatively implement the monitoring plan will need to be made following the completion of watershed analysis .

The project leader should also remind leaders of the assessment teams and the prescription team that they should document information on situations that would benefit from monitoring and record that information in module write-ups. At synthesis, the assessment module team leaders should discuss potential monitoring ideas as part of the assessment module presentations.

Step 2: Identifying Watershed-Specific Monitoring Objectives

One of the most important tasks is to clearly identify specific monitoring goals to provide the focus needed for a successful monitoring plan.

The primary goal of watershed analysis monitoring is to determine if watershed analysis has been effective in achieving resource management objec-

tives. This section provides guidance for translating this general goal into specific monitoring objectives for each watershed.

Developing specific monitoring objectives is a critically important step in putting together an effective monitoring program. Specific monitoring objectives will keep the monitoring program focused and efficient, and help ensure that the information collected serves a useful purpose. The procedure in this section provides a means of identifying, evaluating and prioritizing potential watershed-specific monitoring objectives.

Identifying potential monitoring objectives

The causal mechanism reports are the main tools used to identify monitoring objectives relating to effectiveness of watershed analysis. Each causal mechanism report identifies a cause and effect relationship between forest practices, input processes and resource effects that can be evaluated with monitoring data. The resource assessment reports and prescriptions are additional sources of useful information for identifying monitoring objectives when used in conjunction with the causal mechanism reports.

Using the monitoring objective work sheet

Form M-1 provides a suggested format to assist in the process of identifying and evaluating potential monitoring objectives, and organizing information useful in evaluating each monitoring objective. As you examine the information discussed above and identify potential monitoring issues or situations, use the suggested format to develop a narrative discussion of each potential monitoring objective. The following section describes the information that should be included in each narrative. However, feel free to include additional applicable information not specified below.

Monitoring objective. There are several potentially useful alternative approaches for identifying monitoring objectives. One approach is to base the monitoring objectives on the cause and effect relationships between input processes and resource conditions described in the causal mechanism reports.

In these cases the monitoring objective will often be to evaluate the effect of the prescriptions on triggering mechanisms, input processes and resource conditions over time. Monitoring to achieve this objective is recommended in cases where the condition of the resource characteristics is determined to be fair or poor as measured by indices of resource condition in the resource assessment reports. An example of a monitoring objective derived from a causal mechanism report (and the relevant prescriptions) might read:

"To evaluate the effectiveness of the road maintenance prescription for Surface Erosion Mapping Unit (SEMU) 2 in reducing fine sediment levels in spawning and incubation habitat in Channel Segment 6."

Another approach used to identify monitoring objectives (which may be faster) begins with identifying a critical resource objective(s). Then the resource assessments and causal mechanism reports are used to identify what input processes are affecting the resource. Work through the relevant cause-effect pathways to identify potential parameters related to the resource of concern. This type of monitoring objective may capture the effect of multiple input processes on a critical resource. A monitoring objective of this type may state:

"To monitor the status of older age-classes of resident cutthroat trout in Segment 10 as a means of evaluating whether the combination of prescriptions affecting LWD recruitment, coarse sediment input and catastrophic events are improving rearing habitat for those age-classes."

Finally, monitoring of the biological resource itself, such as fish populations, may provide a means of truly understanding the biological response to input processes and channel conditions.

Source. List the source of information that each monitoring objective is based on, such as a specific causal mechanism report, resource assessment report, assessment or prescription team suggestion, etc.

Monitoring hypothesis. The next question requires formulation of a hypothesis for each monitoring objective. Where the monitoring objective is based on a causal mechanism or resource assessment report, the cause and effect relationship needed to develop a monitoring hypothesis has already been identified. For example, a hypothesis based on a causal mechanism report might state:

"The road maintenance prescription for SEMU 2 will reduce sediment delivery to the stream system, reducing fine sediment levels in spawning and incubation habitat in Channel Segment 6."

Current status. Describe the current situation using information in the causal mechanism and resource assessment reports, and the knowledge of team members. Discuss the past effects of natural events, forest practices and other activities that have contributed to current conditions. An example of a description of current status may state:

"Surface erosion from roads in SEMU 2 has been delivering moderate amounts of fine sediment to the stream system for the last ten years. A large storm event in 1989 deposited large amounts of fine sediment from upstream bank erosion and mass wasting. Spawning gravel fine sediment levels in channel segment 6 are elevated (mean of 16.1% <0.85 mm)."

Future prognosis. The future prognosis should be developed by assessment team members based on the current situation, the expected response to future management, and natural disturbance/recovery cycles. Watersheds are dynamic physical systems subject to natural or management-induced disturbances that create cycles of disturbance and recovery over time so a variety of future outcomes are possible. The time-frame required for recovery from disturbance depends upon factors such as the magnitude of disturbance, the frequency of disturbance, distribution of the disturbance over the stream network, the type of process involved, and inter-relationships with other processes. To determine if a system is responding as predicted in the monitoring hypothesis, it is important to know the time-frame over which changes, such as recovery from past disturbance, are expected to occur. It is also important to identify other factors that could affect the rate or direction of change over time. This information will help in the evaluation of resource recovery in WAC 222-22-090 *(4) by establishing realistic expectations for resource response. An example of a future prognosis might read:

"Implementation of the road maintenance prescription in SEMU 2 is expected to result in a decrease in fine sediment delivery to the stream channel. Reduction in the spawning gravel fine sediment levels in Segment 6 is expected to occur over the next 5-10 years, at which time levels should stabilize at a mean of less than 12% <0.85mm. Mass wasting and/or bank erosion associated with a large peak flow event could temporarily reverse or slow the recovery process."

This is also a place to capture critical uncertainties which arise due to the fact that we may not have a thorough knowledge of a watershed process, or we cannot accurately predict the probability of disturbance or the rate of recovery.

Potential monitoring parameters and their feasibility. The next part of the work sheet provides spaces to record potential monitoring parameters and comments about their feasibility and applicability to the monitoring objective. This is an identification of the basic "how to's" for possible monitoring. Detailed plans will be developed during cooperative implementation for selected objectives.

A parameter is defined as a variable used as an indicator to gage in a quantitative manner whether there has been a change to part of a system. Be specific when identifying parameters, keeping in mind what data needs to be generated and how it will be analyzed and used. For example, pool habitat is too general to be a useful monitoring parameter. More specific parameters are used to measure pool habitat depending on the linkage to input processes that are being monitored. Examples of parameters to measure pool habitat include: pool surface area as a percentage of total surface area, channel widths per pool, and residual pool depth.

Spaces are provided for parameters related to input processes, triggering mechanisms, channel effects, habitat effects and water quality effects. All types of parameters will not be relevant in each case so fill out only the appropriate ones for each monitoring objective.

Use the comment section to record factors such as relevance or feasibility that make certain parameters better choices than others for inclusion in the monitoring plan. For example, measuring changes in stream flow may be very expensive and require a long period in order to produce a meaningful data set.

Appendix A shows a variety of possible parameters for triggering mechanisms, channel, and fish habitat effects and the input processes that they are associated with. See MacDonald et al. (1991) and the TFW Ambient Monitoring Program Manual for additional information on monitoring parameters related to forest practices and their effects.

Step 3: Determining monitoring objectives

The next step is to finalize and prioritize the potential monitoring objectives. This step involves winnowing through the possible objectives and narrowing the field to those which will be most efficient, useful and informative, and eliminating those not meeting these criteria.

Selection of final monitoring objectives is a judgment of the team about the relative importance of the objectives and their ability to answer the key questions. The worksheet information is useful for evaluating and comparing potential monitoring objectives, but does not provide a formula for final selection among objectives. Use Form M-3 to document the selected objectives. If priorities are determined among final monitoring objectives, note relative importance as a comment.

Step 4: Prepare a Monitoring Plan Report

Once the final monitoring objectives have been identified and prioritized, the team assembles this information in written form. The monitoring plan is not part of the final Watershed Analysis Report submitted to DNR for approval, however it should be filed with DNR as a separate report for future reference. The monitoring report should include the selected monitoring objectives and document the process used to identify and select these parameters.

Section 2. Cooperative Implementation of Watershed Analysis Monitoring

Implementation of the monitoring plan is done through cooperative efforts by stakeholders. As such, the actual monitoring done depends on resources available through various stakeholders and their commitment of those resources to a monitoring program. There will be cases where no monitoring is done, cases where some of the plan is done and cases where the plan is done as designed.

Step 1: Determine the amount of cooperative commitment for implementation of monitoring

The project manager for the watershed analysis convenes a meeting of interested stakeholders to discuss the monitoring plan report and determine the level of interest in cooperative implementation of a monitoring program. The monitoring plan report provides guidance for monitoring to answer the key questions. Additional monitoring goals may be discussed. Stakeholders should be encouraged to help implement the developed plan first, before adding additional objectives.

Determine the commitment of cooperative resources to a monitoring program. Determine any specific commitments to individually identified objectives. Based on the level of cooperative commitment of resources, decide whether to proceed with detailed development of a monitoring program.

Select a coordinator from volunteering cooperators to manage the development of a monitoring workplan and coordinate its implementation. The coordinator works with cooperators, ensuring that monitoring is carried out on schedule and according to plan. A feedback loop is recommended to provide for review and revision of the monitoring workplan to ensure that program objectives are being met. The coordinator structures meetings as needed to share results, review progress and distribute data. The coordinator should be experienced in project management with some knowledge in operational monitoring and quality assurance.

Step 2: Develop a cooperative monitoring workplan

The actual design of monitoring activities needs to be done with utmost care. The goal is credible data that answers the key questions. Use standard methods, such as those developed by the TFW Ambient Monitoring Steering Com-

mittee or other recognized available methods, to provide the needed consistent quality of data. Poorly designed monitoring will not provide answers to the questions being asked. It is recommended that special expertise be recruited to assist in this effort. Experience in natural resources monitoring and statistical design of sampling programs is recommended. The TFW Ambient Monitoring Steering Committee has experience and knowledge in this area and could be called on for assistance and advice.

Based on the commitments made in Step 1, develop a detailed workplan for the selected objectives. For each selected objective, the details for parameters to sample are defined. Sampling design should include such factors as sampling location, sampling intensity, sampling methods, sampling schedule and quality control/quality assurance. Data analysis needs should be considered. Completion of the module includes a report developed cooperatively by the participants that summarizes results. Form M-4 provides a possible format for organizing the elements of the monitoring workplan.

Step 3: Implement the workplan

The actual implementation of the monitoring workplan is done by participating cooperators as agreed on during the development of the monitoring program. Each cooperator assumes the operational responsibility for their respective portion of the program. It is essential that all cooperators follow through with their commitment, ensuring that procedures, schedules and

Table M-2. Monitoring Module Task Checklist

Review	Task	Schedule	Complete
	Project manager instructs each resource assessment team leader and prescription team leader to identify potential monitoring objectives.		
	Assessment teams identify potential monitoring objectives.		
X	Assessment team leaders discuss potential monitoring objectives during the module report presentations.		
	Prescription teams identify potential monitoring objectives.		
	Wrap-up team discusses potential monitoring objectives.		
	Wrap-up team selects final monitoring objectives for inclusion in the monitoring plan.		
X	Prepare the monitoring plan report for filing with DNR.		

quality controls are carried out as designed. Individuals taking the samples should be adequately trained in the field procedures assigned. The TFW Ambient Monitoring Steering Committee provides training in proper field procedures for many parameters and additional methods are being developed. Cooperators will work with the coordinator during implementation of the workplan.

Acknowledgments

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References

MacDonald, L.H., A.W. Smart and R.C. Wissmar. 1991. Monitoring guidelines to evaluate the effects of forestry activities on streams in the Pacific Northwest. EPA/910/9-91-001. Environmental Protection Agency. Seattle.

Schuett-Hames, D., A. Pleus, L. Bullchild and S. Hall. 1993. TFW Ambient Monitoring Program Manual. Northwest Indian Fisheries Commission. Olympia.

Schuett-Hames, D. and G. Pess. 1994. A strategy to implement watershed analysis monitoring. Northwest Indian Fisheries Commission. Olympia.

Form M-1. Outline for Cooperative Monitoring and Objective Worksheet

WAU _____

Date _____

Potential Monitoring Objective

Source

Monitoring Hypothesis

Current Status

Future Prognosis

Potential Monitoring Parameters

Input Process

Triggering Mechanisms

Channel Effects

Habitat Effects

Water Quality Effects

Form M-2. Prioritizing Cooperative Monitoring Objectives Worksheet

Priority Number/ Objective Number	Monitoring Objective	Reasoning/Comments

Form M-3. Outline for Watershed Analysis Cooperative Monitoring Objective Description

WAU _____ Date _____

Monitoring Objective Priority Number _____

Monitoring Objective

Source

Monitoring Hypothesis

Current Status

Future Prognosis

Monitoring Parameters Selected

Form M-4. Outline for Watershed Analysis Cooperative Monitoring Workplan Parameter Description

WAU_____Date _____

Monitoring Objective Priority Number _____

Parameter

Type of Parameter

Sampling Location

Data Collection Methods

Sampling Design and Procedures

Data Analysis Procedures

Quality Assurance Plan

Products

Roles and Responsibilities of Participants

Lead Organization:

Project Leader:

Phone:

Address:

Possible Parameters for Watershed Analysis Cooperative Monitoring

The following parameters have been identified from existing Watershed Analysis Causal Mechanism Reports. Currently the only CMER approved standard methods are in the TFW Ambient Monitoring Program Manual (July 1993). Additional parameters will be added to the list as identified in the future. When developing standard methods for each parameter it is desirable to consider both high and low methods for stakeholders to be able to chose from. Development and adoption of additional standard methods for other parameters is dependent upon future efforts and/or funding. (A Strategy to Implement Watershed Analysis Monitoring 1994)

Triggering mechanisms

- Aerial photo landslide inventory
- Slope stability analysis
- Deep-seated landslides
- Road assessment procedure
- Surface erosion survey
- Fine sediment delivery
- Aerial photo survey of riparian vegetation
- LWD recruitment
- Aerial photo survey of rain-on-snow (ROS) zone vegetation
- Site-specific peak flow runoff monitoring

Channel effects

- Channel substrate size (fining or coarsening)
- Channel aggradation or degradation
- Channel widening, braiding, lateral migration and bank erosion
  - Aerial photo method
  - Field methods
- Sediment storage features

Fish habitat effects

- Spawning gravel scour
- Redd de-watering
- Spawning gravel sedimentation and redd entombment (TFW AM Manual)
- Spawning gravel availability
- Water temperature (TFW AM Manual)
- De-watered habitat (sub-surface flow) (TFW AM Manual)
- Macro-invertebrates
- Pool rearing habitat (TFW AM Manual)
- Overhead/instream cover
- Pool refuge habitat
- Interstitial refuge habitat
- Large woody debris (LWD) refuge cover
- Off-channel refuge habitat
- Adult holding pools
- Passage blockage